(Amendment under Article 34 PCT)

CLAIMS

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2. An electro luminescence device comprising a [compound semiconductor crystal substrate comprising a Group 12 (2B) element and a Group 16 (6B) element in a periodic table,]

wherein the electro luminescence device is produced by disposing a diffusion source including an element converting the substrate of a first conduction type into the one of a second conduction type on a front surface of the substrate; forming a pn junction by heat treating and thermally diffusing the diffusion source; and forming electrodes on front and rear of the substrate,

and wherein dislocation density of the substrate is not more than 20,000/cm^2, ~~or~~ density of pits which are obtained by etching the substrate with sodium hydroxide aqueous solution at from 90°C to 130°C [is not more than 20,000/cm^2].

3. The electro luminescence device as claimed in claim 2, wherein the inclusion density on an interface of the pn junction is not more than 50,000/cm^2.

4. The electro luminescence device as claimed in claim 2 or claim 3, wherein density of inclusions having grain diameters of 0.3μm to 10μm on an interface of the pn junction, the inclusions being able to be observed in a

focal field of an optical microscope of X100 to X200 magnification, is not more than 100,000/cm^2.

5. The electro luminescence device as claimed in any one of claim 2 to claim 4, wherein the substrate is made of any one of ZnTe, ZnSe and ZnO.

6. The electro luminescence device as claimed in any one of claim 2 to claim 5, wherein wavelengths of light emitted from both light emitting regions sandwiching an interface of the pn junction are different from each other.

7. The electro luminescence device as claimed in claim 6, wherein when the substrate is p-type ZnTe, and the diffusion source is Al, Ga, In, or alloy including them, the light emitted from the light emitting region in a side of the diffusion source against the interface of the pn junction is from green light to red light having a wavelength of from 550nm to 700nm, while the light emitted from the light emitting region in a side of the substrate is from yellow light to red light having a wavelength of from 580nm to 700nm.

8. A method for producing an electro luminescence device, comprising the steps of:

providing a compound semiconductor crystal substrate comprising a Group 12 (2B) element and a Group 16 (6B) element in a periodic table;

disposing a diffusion source on a front surface of the substrate, the diffusion source including an element

converting the substrate of a first conduction type into the one of a second conduction type;

forming a pn junction by heat treating and thermally diffusing the diffusion source; and

forming electrodes on front and rear of the substrate;

wherein the diffusion source disposed on the front surface of the substrate comprises a material including an element preventing forming of a defect compensating an impurity level which is formed in the substrate by the element included in the diffusion source during a diffusion process, or an element gettering impurity on the front surface of the substrate.

9. The method for producing an electro luminescence device as claimed in claim 8, wherein the defect compensating the impurity level which is formed in the substrate by the element included in the diffusion source, is a vacancy or a defect including the vacancy.

10. The method for producing an electro luminescence device as claimed in claim 8 or claim 9, wherein the diffusion source disposed on the front surface of the substrate comprises an element such that Gibbs' free energy of a compound which is formed by combining the diffusion source and impurity is smaller than Gibbs' free energy of a compound which is formed by combining an constitute element in the substrate and the impurity at a diffusion process

temperature, or a material including the element.

11. The method for producing an electro luminescence device as claimed in any one of claim 8 to claim 10, wherein the diffusion source is Al, Ga, In, or alloy thereof.

12. The method for producing an electro luminescence device as claimed in any one of claim 8 to claim 10, wherein the diffusion source is Cl, Br, I, or alloy thereof.

13. The method for producing an electro luminescence device as claimed in any one of claim 8 to claim 12, wherein the element included in the diffusion source and gettering impurity in the substrate has a slow diffusion rate in the substrate compared with the element converting the substrate of the first conduction type into one of the second conduction type.

14. The method for producing an electro luminescence device as claimed in any one of claim 8 to claim 13, wherein the impurity is at least one of O, Li, Ag, Cu and Au.

15. The method for producing an electro luminescence device as claimed in claim 13 or claim 14, wherein the element included in the diffusion source, and gettering the impurity in the substrate is at least one of B, Si and C.

16. The method for producing an electro luminescence device as claimed in any one of claim 8 to claim 15, wherein the diffusion source is deposited over the front

surface of the substrate under vacuum by any one of a sputtering method, a resistance heating method, and an electron beam method.

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17. The method for producing an electro luminescence device as claimed in any one of claim 8 to claim 16, wherein a heat treating temperature at the diffusion is 300°C to 700°C.

18. The method for producing an electro luminescence device as claimed in any one of claim 8 to claim 17, wherein a thickness of the diffusion source before performing the heat treatment is 1,000Å to 10,000Å, preferably, 1,500Å to 5,000Å.

19. The method for producing an electro luminescence device as claimed in claim 18, wherein the diffusion source remains on the front surface of the substrate with a predetermined thickness after the heat treatment.

20. The method for producing an electro luminescence device as claimed in claim 18 or claim 19, wherein a thickness of a remained diffusion source and a diffusion layer is not less than 100Å, preferably, not less than 300Å.

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21. The method for producing an electro luminescence device as claimed in any one of claim 17 to claim 20, wherein the diffusion source is Al or In, and the diffusion source is heat treated on a condition that diffusion time is longer than the one specified by a relational expression $Y= 2 \times 10^{5}\exp(-0.018T)$, showing a relation between

diffusion time Y and a heat treating temperature T.

22. The method for producing an electro luminescence device as claimed in any one of claim 8 to claim 21, wherein the substrate is ZnTe.

23. A method for producing an electro luminescence device, comprising the steps of:

providing a compound semiconductor crystal substrate comprising a Group 12 (2B) element and a Group 16 (6B) element in a periodic table;

disposing a diffusion source on a front surface of the substrate, the diffusion source including an element converting the substrate of a first conduction type into the one of a second conduction type;

forming a pn junction by heat treating and thermally diffusing the diffusion source; and

forming electrodes on front and rear of the substrate;

wherein the diffusion source is disposed on a substrate plane having plane orientation from which a flat plane is obtained after etching.

24. The method for producing an electro luminescence device as claimed in claim 23, wherein the substrate is any one of ZnTe, ZnSe and ZnO.

25. The method for producing an electro luminescence device as claimed in claim 23 or claim 24, wherein the substrate plane having the plane orientation from which a

flat plane is able to be obtained after etching is (111)Zn plane, (001) plane, or (011) plane.

26. The method for producing an electro luminescence device as claimed in claim 23 or claim 24, wherein the substrate plane having the plane orientation from which a flat plane is able to be obtained after etching has an inclining angle within 10 degrees from (111)Zn plane, (001) plane, or (011) plane.

27. The method for producing an electro luminescence device as claimed in any one of claim 23 to claim 26, wherein before the diffusion source is disposed, the front surface of the substrate is chemically etched.

28. The method for producing an electro luminescence device as claimed in claim 27, wherein the chemical etching is performed with etchant of bromic acid system or bromine system.

29. A method for producing an electro luminescence device, comprising the steps of:

providing a compound semiconductor crystal substrate comprising a Group 12 (2B) element and a Group 16 (6B) element in a periodic table;

disposing a diffusion source on a front surface of the substrate, the diffusion source including an element converting the substrate of a first conduction type into the one of a second conduction type;

forming a pn junction by heat treating and thermally

diffusing the diffusion source; and

forming electrodes on front and rear of the substrate;

wherein a film thickness of the diffusion source is from 5nm to 50nm.

30. The method for producing an electro luminescence device as claimed in claim 29, wherein a film thickness of the diffusion source is from 5nm to 20nm.

31. The method for producing an electro luminescence device as claimed in claim 29 or claim 30, wherein a treating temperature for the thermal diffusion is from 300°C to 550°C.

32. The method for producing an electro luminescence device as claimed in any one of claim 29 to claim 31, wherein treatment time for the thermal diffusion is determined so as to have such a range that the diffusion source remains in not less than a predetermined thickness after the diffusion process.

33. The method for producing an electro luminescence device as claimed in any one of claim 29 to claim 32, wherein the substrate is any one of ZnTe, ZnSe and ZnO.

34. The method for producing an electro luminescence device as claimed in any one of claim 29 to claim 33, wherein the diffusion source is Al, Ga, In, or alloy thereof.

35. An electro luminescence device comprising a compound

semiconductor crystal substrate comprising a Group 12 (2B) element and a Group 16 (6B) element in a periodic table,

wherein the electro luminescence device is produced by disposing a diffusion source including an element converting the substrate of a first conduction type into the one of a second conduction type on a front surface of the substrate; forming a pn junction by heat treating and thermally diffusing the diffusion source; and forming electrodes on both surfaces of the substrate, and

the compound semiconductor crystal substrate has carrier density of from 1 X $10^{17}cm^{-3}$ to 5 X $10^{18}cm^{-3}$.

36. The electro luminescence device as claimed in claim 35, wherein the compound semiconductor crystal substrate has desired carrier density by doping determined amount of a Group 15 (5B) element in the periodic table.

37. The electro luminescence device as claimed in claim 35 or claim 36, wherein the substrate is any one of ZnTe, ZnSe and ZnO.

38. The electro luminescence device as claimed in claim 35 or claim 37, wherein the diffusion source is Al, Ga, In, or alloy thereof.

39. An electro luminescence device comprising a compound semiconductor crystal substrate comprising a Group 12 (2B) element and a Group 16 (6B) element in a periodic table,

wherein the electro luminescence device is produced by disposing a diffusion source including an element

converting the substrate of a first conduction type into the one of a second conduction type on a front surface of the substrate; forming a pn junction by heat treating and diffusing the diffusion source; and forming electrodes on both surfaces of the substrate, and

a depth of the diffusion is not less than 0.3μm and not more than 2.0μm from the front surface of the substrate.

40. The electro luminescence device as claimed in claim 39, wherein a luminescence center wavelength is from 550nm to 570nm.

41. The electro luminescence device as claimed in claim 39 or claim 40, wherein the substrate is any one of ZnTe, ZnSe and ZnO.

42. The electro luminescence device as claimed in any one of claim 39 to claim 41, wherein the diffusion source is Al, Ga, In, or alloy thereof.

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